

# The impact of growth rate on the results of growth and slaughter traits of young crossbred boars in Poland in Bydgoszcz Breeding Region

## Wpływ tempa wzrostu na wyniki cech tucznych i rzeźnych knurków mieszańców ocenionych przyŚyciowo w Polsce w bydgoskim okręgu hodowlanym

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### ABSTRACT

There was analysed the impact of growth rate on the results of growth and slaughter traits of 3917 young crossbred boars performance tested in years 2004-2008 in Poland in The Bydgoszcz Breeding Region. They came from 8 following crossing variants, where sow's breed was given in a first position and boar's breed in a second position: Hampshire x Belgian Landrace (H x BL), Hampshire x Duroc (H x D), Hampshire x Pietrain (H x P), Duroc x Hampshire (D x H), Duroc x Pietrain (D x P), Pietrain x Hampshire (P x H), Pietrain x Duroc (P x D) and Line 990 x Pietrain (990 x P). The impact of growth rate on the results' formation in the range of tested traits noted in different degrees. It was the most visible in the growth traits (age and body weight) and the performance test selection index and less visible in the slaughter traits, among which the most visible in case of the backfat thickness measured in P2 and P4 points and then in the meat content and the height of loin eye. In the analyzed years tested young crossbred boars of the high growth rate, i.e. of high daily gain of body weight standardized on the 180th day of life were younger and generally obtained higher body weight and higher performance test selection index and in the majority of cases, where the statistically significant differences were proved, had thinner backfat in the P2 and P4 points and had lower meat content and the higher height of loin eye as compared to the animals of low growth rate.

**Keywords:** daily gain of body weight, backfat thickness, meat content, performance test selection index, young crossbred boars

### ABSTRAKT

Analizowano wpływ tempa wzrostu na wyniki cech tucznych i rzeźnych 3917 knurków mieszańców ocenionych przyŚyciowo w latach 2004-2008 w Polsce w bydgoskim okręgu hodowlanym. Pochodziły one z następujących 8 wariantów krzyŜowania, w

których rasę lochy podano w pierwszej pozycji a knura w drugiej: hampshire x belgijska zwisloucha (h x bz), hampshire x duroc (h x d), hampshire x pietrain (h x p), duroc x hampshire (d x h), duroc x pietrain (d x p), pietrain x hampshire (p x h), pietrain x duroc (p x d) i linia 990 x pietrain (990 x p). Wpływ tempa wzrostu na kształtowanie się wyników w zakresie badanych cech zaznaczył się w różnym stopniu. Najbardziej był widoczny w cechach tucznych (wiek i masa ciała) oraz indeksie selekcyjnym oceny przyśyciowej a w mniejszym stopniu w cechach rzeźnych, spośród których najbardziej w przypadku grubości słoniny mierzonej w punktach P2 i P4 a następnie w zawartości mięsa i wysokości oka polędwicy. W analizowanych latach badane knurki mieszańce o wysokim tempie wzrostu, tj. wysokim przyroście dobowym masy ciała standaryzowanym na 180. dzień ścicia były młodsze oraz osiągnęły na ogół większą masę ciała i wyższy indeks selekcyjny oceny przyśyciowej oraz w większości przypadków, w których udowodniono statystycznie istotne różnice charakteryzowały się cieńszą słoniną w punktach P2 i P4 oraz mniejszą mięsnością i większą wysokością oka polędwicy w porównaniu ze zwierzętami o niskim tempie wzrostu.

**Słowa kluczowe:** przyrost dobowy masy ciała, grubość słoniny, mięsność, indeks selekcyjny oceny przyśyciowej, knurki mieszańce

## DETAILED ABSTRACT

Wieloletnie intensywne prace hodowlane nad trzodą chlewną przyczyniły się do bardziej efektywnego wykorzystania paszy, zwiększenia przyrostu dobowego masy ciała prowadzącego do wzrostu odkładania białka w ciele i w konsekwencji do większego umięśnienia zwierząt. Jednak wyniki badań niektórych autorów sugerują, że zbyt wysokie tempo wzrostu może niekorzystnie wpływać na wartość rzeźną świń szczególnie przy żywieniu ad libitum, prowadząc do obniżenia mięsności i zwiększenia otłuszczenia.

Celem pracy było określenie wpływu tempa wzrostu na wyniki cech tucznych i rzeźnych 3917 knurków mieszańców pochodzących z następujących wariantów krzyżowania, w których rasę lochy podano w pierwszej pozycji a knura w drugiej: hampshire x belgijska zwisloucha (h x bz), hampshire x duroc (h x d), hampshire x pietrain (h x p), duroc x hampshire (d x h), duroc x pietrain (d x p), pietrain x hampshire (p x h), pietrain x duroc (p x d) i linia 990 x pietrain (990 x p) ocenionych przyśyciowo w Polsce w bydgoskim okręgu hodowlanym w latach 2004-2008 zgodnie z obowiązującą metodyką. W zależności od tempa wzrostu knurki pochodzące z poszczególnych wariantów krzyżowania podzielono na dwie grupy o zróżnicowanym tempie wzrostu a więc charakteryzujące się niskim i wysokim przyrostem dobowym masy ciała według określonego schematu. Statystyczne opracowanie wyników przeprowadzono stosując jednoczynnikową analizę wariancji. Istotność różnic między grupami o zróżnicowanym tempie wzrostu w obrębie każdego wariantu krzyżowania w danym roku weryfikowano testem t-Studenta. Do obliczeń wykorzystano program komputerowy Statistica 8.0 PL (2008). Wpływ tempa wzrostu na kształtowanie się wyników w zakresie badanych cech zaznaczył się w

róŜnym stopniu. Najbardziej był widoczny w cechach tucznych (wiek i masa ciała) oraz indeksie selekcyjnym oceny przyŜyciowej a w mniejszym stopniu w cechach rzeźnych, spośród których najbardziej w przypadku grubości słoniny mierzonej w punktach P2 i P4 a następnie w zawartości mięsa i wysokości oka polędwicy. W analizowanych latach badane knurki mieszańce o wysokim tempie wzrostu, tj. wysokim przyroście dobowym masy ciała standaryzowanym na 180. dzień Ŝycia były młodsze oraz osiągnęły na ogół większą masę ciała i wyŜszy indeks selekcyjny oceny przyŜyciowej oraz w większości przypadków, w których udowodniono statystycznie istotne róŜnice ( $P \leq 0,01$  lub  $P \leq 0,05$ ) charakteryzowały się cieńszą słoniną w punktach P2 i P4 oraz mniejszą mięsnością i większą wysokością oka polędwicy w porównaniu ze zwierzętami o niskim tempie wzrostu.

## INTRODUCTION

Many years of intensive work on the pigs has contributed to more efficient use of feed, increase of the daily gain of body weight leading to raise of the body protein deposition and consequently to higher meat content of the animals (Cameron and Curran, 1995a, 1995b; Fuller et al., 1995). However, the results of some authors suggest that too high growth rate may unfavourable impact on the slaughter value of the pigs, especially with ad libitum feeding, leading to decrease of the meat content and increase of the fat content (Buczyński et al., 2001; Kanis, 1988; Kapelański et al., 2002; Knap, 1987; Michalska et al., 2002, 2003; Milewska and Falkowski 2001; Urbańczyk et al., 1999). However, the studies of Gy, et al. (1992) and Cameron, et al. (1999) indicate that high growth rate of the pigs of high genetical capacity to the protein deposition does not impact on increase of the fat content.

In a modern breeding and rearing of the pigs crossbred boars are increasingly used, which as compared to the purebred animals are characterized by earlier puberty, higher testicular weight, higher volume of semen of better quality, higher breeding performance regarding to higher libido, higher insemination efficiency and the possibility to their longer use (Czarnecki et al., 1998; Fent et al., 1980; Kapelański, 1995; Koczanowski et al., 2001; Michalski and Polańska, 1983; Neely and Robison, 1983; Nowachowicz, 2004; Rak et al., 1993).

The results of performance test are one of the main criteria in selection-work when animals are chosen to breeding and producing herds (RóŜycki, 2003). The breeding value of performance tested pigs depends on their growth rate and the body meat content. The performance test has a special role in conducted selection, especially the male individuals, because of their breeding value depends largely on the level of productivity of breeding and mass livestock of the pigs. In the recent years, among the paternal components of pigs performance tested in Poland beside young purebred boars such as Belgian Landrace, Hampshire, Duroc, Pietrain and synthetic Line 990 there are also two-breed crossbred young boars came from their crossing. The aim of presented paper was to determine the impact of growth rate on the results of growth and slaughter traits of young crossbred boars in Poland in Bydgoszcz Breeding Region.

## MATERIALS AND METHODS

The impact of growth rate on the results of growth and slaughter traits of 3917 young crossbred boars intended for further breeding has been examined. The animals were produced and performance tested in years 2004-2008 in Poland within The Bydgoszcz Breeding Region (Kujawy-Pomorze Province) according to the obligatory methodology (Eckert and Szyndler-Nędza, 2005). The body meat content of young crossbred boars was estimated on the base of ultrasound measurements of the backfat thickness in the P2 and P4 points and the height of loin eye in the P4 measurement point, carried out using PIGLOG 105 apparatus.

Performance test selection index was calculated according to the formula (Eckert and Szyndler-Nędza, 2005):

$$I_o = 0,1364 X_1 + 4,7820X_2 - 275,5944 \text{ where:}$$

$I_o$  - paternal lines selection index

$X_1$  – daily gain standardized on 180th day of life

$X_2$  – percentage body meat content.

The young crossbred boars came from 8 following crossing variants, where sow's breed was given in a first position and boar's breed in a second position: Hampshire x Belgian Landrace (H x BL), Hampshire x Duroc (H x D), Hampshire x Pietrain (H x P), Duroc x Hampshire (D x H), Duroc x Pietrain (D x P), Pietrain x Hampshire (P x H), Pietrain x Duroc (P x D) and Line 990 x Pietrain (990 x P). Depending on the growth rate, i.e. the height of daily gain of body weight standardized on the 180th day of life young crossbred boars came from different crossing variants were divided into two groups of different growth rate, thus of low and high daily gain of body weight according to the scheme given in Table 1. The number of tested animals was given in Tables 2-6.

The results were statistically elaborated using the one-way variance analysis. The significance of differences between the groups of different growth rate within each crossing variant in a particular year was verified by t-Student's test. The calculations were made using computer program Statistica 8.0 PL (2008).

## RESULTS

The number of animals and the results of growth and slaughter traits were given in the tables 2-6. The animal material was very numerous and covered almost 4000 young two-breed crossbred boars came from 8 crossing variants, performance tested in Poland in The Bydgoszcz Breeding Region in the 5 following years (2004-2008). The animals of high daily gain of body weight were younger and obtained generally higher body weight on the performance test day (except crossbreds: H x BL in 2004

and 2005, H x P in 2005, 990 x P in 2006 and H x D in 2007) as compared to the pigs of low growth rate (tables 2-6). The data regarding the daily gain of body weight standardized on 180th day of life (tables 2-6) clearly results that in the tested years in case of all crossing variants the differences between the groups of young boars of the low and high growth rate were high and statistically high significant.

The growth rate generally impacted on the standardized backfat thickness in the point P2 (tables 2-6). Detailed analysis of the results of the groups of pigs of low and high growth rate on 26 tested cases (regarding to particular year and the crossing variant) in 17 cases statistically high significant or statistically significant differences stated, among them in the majority of cases (12) young crossbred boars of the high growth rate had thinner backfat measured in the P2 point. It was observed in the following years in the animals from the groups: 2004 H x D; 2005 H x D, D x P; 2006 H x D, D x P; 2007 D x P, P x H, P x D; 2008 H x P, D x P, P x H, P x D. In 5 following cases the inverse relationship was observed: 2004 H x BL; 2005 H x BL, H x P, P x D; 2006 990 x P. Regarding to the backfat thickness in the P4 point (tables 2-6) it was also stated similar trends as in the backfat thickness measured in the point P2. It was observed that in case of 15 indicated significances of differences in the 11 cases young crossbred boars of the high growth rate had thinner backfat (2004 H x D; 2005 H x D; 2006 H x D, D x P; 2007 D x H, D x P, P x H, P x D; 2008 H x P, D x P, P x D). In the 4 cases opposite trend was observed, thus the animals of the high growth rate had thicker backfat (2004 D x P, P x H; 2005 H x P, P x D).

The impact of the growth rate on the results of the standardized height of loin eye in the P4 point was lower than on the fat content of pigs characterized on the base of the backfat thickness measurements in the P2 and P4 points (tables 2-6). In analyzed years in the pigs from some crossing variants 10 significances of differences were proved between the groups of low and high daily gain of the body weight (the 26 cases under consideration taking into account tested years and the crossing variants). All of them show the same trend - young crossbred boars of the high growth rate had more favourable result of the standardized height of loin eye in the P4 point as compared to the pigs of low daily gains of the body weight. They concerned following years and crossing variants: 2004 D x P, P x H; 2005 H x D, H x P, D x P; 2006 D x P, 990 x P; 2007 D x P, P x H; 2008 D x P. It should be noticed, that the impact of the growth rate on standardized body meat content of young crossbred boars in analyzed years (tables 2-6) was proved in the half of cases (according to years and the crossing variants). Among 13 statistically high significant or significant differences which were stated between the groups of different growth rate, majority of them (8) concerned the trend that young crossbred boars of the high growth rate had unfortunately lower meat content. It was observed in the following years in the pigs from such crossing variants as: 2004 D x P; 2005 H x BL, H x P, D x P, P x H, P x D; 2006 990 x P; 2007 H x P. However, in 5 cases the animals of high



daily gains of the body weight had higher body meat content: 2004 H x D; 2007 P x H; 2008 H x P, D x P, P x D.

In the analyzed period among tested crossing variants young boars of the high growth rate obtained higher value of the performance test selection index as compared to the animals of low daily gains of the body weight (tables 2-6). The differences in this range between the groups of pigs of different growth rate were high and in the majority statistically high significant or significant.

## DISCUSSION

In Poland and other countries conducted selection based on i.e. performance test results of pigs in the direction to increase the growth rate through the control of the daily gain of body weight and increase the meat content conducted on the base of the backfat thickness measurements and the height of loin eye caused a significant progress of the genetic value of animals (Bobček et al., 2002; Cameron and Curran, 1995b; Chen et al., 2003; McKay, 1990; RóŜycki, 2003). However, the obtained results should be analyzed currently, because too intensive increase of the performance of pigs may cause disorders and changes in the genetic homeostasis of the relations between the groups of traits (Falkenberg et al., 1989). The results of performance test of tested young boars were presented in other publication (Michalska et al., 2010). There was observed, that regarding to the best results of growth and slaughter traits Hampshire x Pietrain crossing variant should be recommended to young crossbred boars production and used as paternal component in crossing programs of the pigs.

In the presented paper in tested young crossbred boars in analyzed years more statistically significant differences were proved between tested groups of pigs of a different growth rate in case when young boars of the high growth rate had thinner backfat in points P2 and P4, the higher height of loin eye and the lower body meat content. The obtained results show an unfavourable impact of the high growth rate on the meat content of young crossbred boars came from some crossing variants in particular years. This is consistent with the previous own results concerning the pure breed pigs (Michalska et al., 2002, 2003). In the research of other authors similar trends were observed, suggesting that the high daily gains of the body weight may impact on decrease of the meat content of pigs (Buczyński et al., 2001; Kanis, 1988; Kapelański et al., 2002; Knap, 1987; Milewska and Falkowski, 2001; Urbańczyk et al., 1999). The modern breeds and lines of the pigs and their crossbreds, including these from tested crossing variants have a different level of the production traits i.e. the daily gains of the body weight (Czarnecki et al., 1998; Eckert and Szyndler-Nędza, 2005; Fandrejewski et al., 2001; Fischer et al., 2002; Glodek et al., 2004; Kapelański et al., 2002; Kawęcka et al., 2008; Michalska et al., 2002, 2003, 2010; Milewska and Falkowski, 2001; Nowachowicz, 2004). Fandrejewski, et al. (2001) observed, that among the growing pigs from the paternal lines there is a significant diversity in the amount of the intaken fodder, what impacts on their growth rate, the body composition and the meat production costs. According to Buczyński, et al.

(2001) forcing too high growth rate may cause decrease of the production pigs profitability.

## CONCLUSIONS

Summarizing the obtained results it should be stated, that the impact of the growth rate on formation of the results in range of tested traits noted in the different degree. It was the most visible in the growth traits (age and body weight) and the performance test selection index and the less visible in the slaughter traits, among them the most visible in case of the backfat thickness measured in the P2 and P4 points, than in the meat content and the height of loin eye. In the analyzed years tested young boars of the high growth rate, i.e. the high daily gain of the body weight standardized on the 180th day of life were younger and obtained generally higher body weight and higher performance test selection index and in the most cases where the statistically significant differences ( $P 0.01$  or  $P 0.05$ ) were proved, had thinner backfat in the points P2 and P4 and lower meat content and higher height of the loin eye as compared to the animals of low growth rate.

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Table 1. The division of young crossbred boars into groups of different growth rate

Tabela 1. Podział knurków mieszańców na grupy o zróżnicowanym tempie wzrostu

Crossing variant Wariant krzyżowania	Daily gain of body weight (g) standardized on 180th day of life Przyrost dobowy masy ciała knurków (g) standaryzowany na 180. dzień życia	
	low - niski	high - wysoki
2004		
Hampshire x Belgian Landrace	up to 631	from 632
hampshire x belgijska	do 631	od 632
zwijsłoucha		
Hampshire x Duroc	up to 637	from 638
hampshire x duroc	do 637	od 638
Hampshire x Pietrain	up to 649	from 650
hampshire x pietrain	do 649	od 650
Duroc x Hampshire	-	-
duroc x hampshire		
Duroc x Pietrain	up to 649	from 650
duroc x pietrain	do 649	od 650
Pietrain x Hampshire	up to 674	from 675
pietrain x hampshire	do 674	od 675
Pietrain x Duroc	up to 679	from 680
pietrain x duroc	do 679	od 680
Line 990 x Pietrain	-	-
linia 990 x pietrain		
2005		
Hampshire x Belgian Landrace	up to 627	from 628
hampshire x belgijska	do 627	od 628
zwijsłoucha		
Hampshire x Duroc	up to 662	from 663
hampshire x duroc	do 662	od 663
Hampshire x Pietrain	up to 668	from 669
hampshire x pietrain	do 668	od 669
Duroc x Hampshire	-	-
duroc x hampshire		
Duroc x Pietrain	up to 657	from 658
duroc x pietrain	do 657	od 658
Pietrain x Hampshire	up to 624	from 625
pietrain x hampshire	do 624	od 625
Pietrain x Duroc	up to 667	from 668
pietrain x duroc	do 667	od 668
Line 990 x Pietrain	-	-
linia 990 x pietrain		

2006

Hampshire x Belgian Landrace	-	-
hampshire x belgijska		
zwijsłoucha		
Hampshire x Duroc	up to 637	from 638
hampshire x duroc	do 637	od 638
Hampshire x Pietrain	up to 667	from 668
hampshire x pietrain	do 667	od 668
Duroc x Hampshire	-	-
duroc x hampshire		
Duroc x Pietrain	up to 650	from 651
duroc x pietrain	do 650	od 651
Pietrain x Hampshire	-	-
pietrain x hampshire		
Pietrain x Duroc	-	-
pietrain x duroc		
Line 990 x Pietrain	up to 614	from 615
linia 990 x pietrain	do 614	od 615

2007

Hampshire x Belgian Landrace	-	-
hampshire x belgijska		
zwijsłoucha		
Hampshire x Duroc	up to 759	from 760
hampshire x duroc	do 759	od 760
Hampshire x Pietrain	up to 730	from 731
hampshire x pietrain	do 730	od 731
Duroc x Hampshire	up to 797	from 798
duroc x hampshire	do 797	od 798
Duroc x Pietrain	up to 664	from 665
duroc x pietrain	do 664	od 665
Pietrain x Hampshire	up to 605	from 606
pietrain x hampshire	do 605	od 606
Pietrain x Duroc	up to 626	from 627
pietrain x duroc	do 626	od 627
Line 990 x Pietrain	-	-
linia 990 x pietrain		

2008

Hampshire x Belgian Landrace	-	-
hampshire x belgijska		
zwijsłoucha		
Hampshire x Duroc	-	-
hampshire x duroc		

Hampshire x Pietrain	up to 731	from 732
hampshire x pietrain	do 731	od 732
Duroc x Hampshire	-	-
duroc x hampshire		
Duroc x Pietrain	up to 688	from 689
duroc x pietrain	do 688	od 689
Pietrain x Hampshire	up to 610	from 611
pietrain x hampshire	do 610	od 611
Pietrain x Duroc	up to 608	from 609
pietrain x duroc	do 608	od 609
Line 990 x Pietrain	-	-
linia 990 x pietrain		

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Table 2. The results of growth and slaughter traits of tested young crossbred boars performance tested in year 2004

Tabela 2. Wyniki cech tucznych i rzeźnych badanych knurków mieszańców poddanych ocenie przyżyciowej w 2004 roku

Traits Cechy	The daily gain of body weight of young boars standardized on 180th day of life (g) Przyrost dobowy masy ciała knurków standaryzowany na 180. dzień życia (g)																	
	H x BL h x b z			H x D h x d			H x P h x p			D x P d x p			P x H p x h			P x D p x d		
	low niski	high wysoki	total łącznie	low niski	high wysoki	total łącznie	low niski	high wysoki	total łącznie	low niski	high wysoki	total łącznie	low niski	high wysoki	total łącznie	low niski	high wysoki	total łącznie
Number, n Liczebność, szt.	9	9	18	16	18	34	16	14	30	46	46	92	31	27	58	42	40	82
Age on test day Wiek w dniu oceny	$\bar{x}$ 172.33a s 0.50	166.11b 7.70	169.22 6.19	161.19 4.69	158.72 9.81	159.88 7.82	181.13a 11.59	170.00b 13.18	175.93 13.39	183.65A 13.72	164.39B 10.81	174.02 15.64	171.26A 8.79	164.15B 8.41	167.95 9.26	177.98A 12.49	167.90B 10.44	173.06 12.54
Body weight on test day Masa ciała w dniu oceny	$\bar{x}$ 105.56 s 0.88	104.11 4.43	104.83 3.19	92.06A 5.62	101.06B 9.21	96.82 8.88	108.56 7.91	111.64 13.48	110.00 10.78	106.24A 8.69	112.02B 8.92	109.13 9.23	105.48 10.75	108.19 8.91	106.74 9.95	108.98A 9.23	116.08B 11.02	112.44 10.69
Daily gain of body weight standardized on 180th day of life Przyrost dobowy masy ciała standaryzowany na 180. dzień życia	$\bar{x}$ 626.44A s 4.82	655.67B 20.95	641.06 21.06	607.13A 14.93	684.83B 40.80	648.26 50.09	600.19A 36.80	677.50B 15.96	636.27 48.51	577.15A 49.05	719.76B 57.78	648.46 89.34	632.10A 33.02	693.37B 11.75	660.62 39.84	619.48A 48.49	719.13B 43.90	668.09 68.04
Standardized backfat thickness in P2 point Standaryzowana grubość słoniny w punkcie P2	$\bar{x}$ 7.78a s 0.67	8.67b 0.87	8.22 0.88	10.69A 1.74	8.83B 0.79	9.71 1.61	8.81 1.22	8.43 1.34	8.63 1.27	9.59 1.68	9.63 1.48	9.61 1.58	9.45 1.65	8.89 1.60	9.19 1.64	8.88 1.55	9.05 1.30	8.96 1.43
Standardized backfat thickness in P4 point Standaryzowana grubość słoniny w punkcie P4,	$\bar{x}$ 9.67 s 1.32	10.44 1.01	10.06 1.21	12.31a 1.82	11.22b 0.73	11.74 1.44	10.38 1.02	10.21 1.42	10.30 1.21	9.33A 1.59	10.48B 1.85	9.90 1.81	9.97a 2.14	11.11b 1.74	10.50 2.03	9.83 1.81	9.60 1.61	9.72 1.71
Standardized height of loin eye in P4 point Standaryzowana wysokość oka połędwicy w punkcie P4	$\bar{x}$ 50.89 s 3.06	52.67 1.41	51.78 2.49	55.69 2.68	57.22 2.96	56.50 2.89	52.81 2.97	53.86 2.48	53.30 2.76	52.04A 4.41	54.39B 4.17	53.22 4.42	54.06a 3.90	56.59b 4.10	55.24 4.16	52.60 4.31	54.10 3.02	53.33 3.79
Standardized body meat content Standaryzowana zawartość mięsa w ciele	$\bar{x}$ 57.59 s 0.83	57.33 1.06	57.46 0.93	56.15A 1.49	57.96B 1.15	57.11 1.59	58.64 1.68	58.36 1.63	58.51 1.64	58.74A 1.86	57.33B 1.44	58.03 1.80	58.10 1.78	58.11 1.30	58.10 1.56	58.51 2.28	58.22 1.58	58.37 1.96
Performance test selection index Indeks selekcyjny oceny przyżyciowej	$\bar{x}$ 85.33 s 3.74	88.11 3.76	86.72 3.91	75.75A 7.82	94.94B 6.66	85.91 12.05	86.63A 9.22	95.79B 8.07	90.90 9.73	84.04A 6.86	96.72B 10.70	90.38 10.98	88.39A 10.61	96.96B 6.20	92.38 9.77	90.19A 13.96	100.88B 7.89	95.40 12.55

Averages in rows within particular breed marked by different letters significantly differ each other; capital letters -  $P \leq 0.01$ ; small letters -  $P \leq 0.05$ Średnie w rzędach w obrębie danej rasy oznaczone różnymi literami istotnie różnią się od siebie; wielkie liter -  $P \leq 0,01$ ; małe litery -  $P \leq 0,05$

Table 3. The results of growth and slaughter traits of tested young crossbred boars performance tested in year 2005

Tabela 3. Wyniki cech tucznych i rzeźnych badanych knurków mieszańców poddanych ocenie przyżyciowej w 2005 roku

Traits Cechy	The daily gain of body weight of young boars standardized on 180th day of life (g) Przyrost dobowy masy ciała knurków standaryzowany na 180. dzień życia (g)																	
	H x BL h x bz			H x D h x d			H x P h x p			D x P d x p			P x H p x h			P x D p x d		
	low niski	high wysoki	total łącznie	low niski	high wysoki	total łącznie	low niski	high wysoki	total łącznie	low niski	high wysoki	total łącznie	low niski	high wysoki	total łącznie	low niski	high wysoki	total łącznie
Number, n Liczba, szt.	20	17	37	39	39	78	69	65	134	190	192	382	104	103	207	191	194	385
Age on test day Wiek w dniu oceny	$\bar{x}$ 183.75A s 7.03	169.53B 8.28	177.22 10.40	187.87A 11.47	175.31B 9.03	181.59 12.05	182.81A 12.05	165.49B 11.14	174.41 14.47	181.82A 11.94	169.85B 12.00	175.80 13.37	191.13A 12.33	173.55B 10.91	182.39 14.58	180.70A 15.22	167.64B 14.20	174.12 16.08
Body weight on test day Masa ciała w dniu oceny	$\bar{x}$ 111.30A s 2.77	107.24B 5.66	109.43 4.75	118.44 8.71	121.26 8.55	119.85 8.69	113.19 7.49	111.91 11.59	112.57 9.68	108.22A 9.27	118.70B 13.64	113.48 12.79	111.25A 10.16	115.52B 9.70	113.38 10.14	106.93A 11.20	115.76B 16.26	111.38 14.64
Daily gain of body weight standardized on 180th day of life Przyrost dobowy masy ciała standaryzowany na 18. dzień życia	$\bar{x}$ 601.00A s 22.15	654.41B 23.14	625.54 35.00	619.87A 32.09	702.62B 32.84	661.24 52.67	617.57A 35.47	709.06B 39.56	661.95 59.19	594.99A 42.53	722.41B 55.76	659.04 80.78	568.03A 37.16	680.07B 30.64	623.78 65.64	594.73A 47.23	718.12B 41.49	656.91 76.06
Standardized backfat thickness in P2 point Standaryzowana grubość słoniny w punkcie P2	$\bar{x}$ 8.13a s 0.77	8.70b 0.87	8.39 0.86	8.79a 1.92	7.98b 1.27	8.39 1.67	8.27a 1.36	8.85b 1.35	8.55 1.38	9.36a 1.48	9.13b 1.67	9.25 1.58	9.12 1.54	8.89 1.41	9.01 1.48	8.65A 1.30	9.05B 1.70	8.85 1.53
Standardized backfat thickness in P4 point Standaryzowana grubość słoniny w punkcie P4	$\bar{x}$ 9.73 s 1.00	9.94 0.92	9.82 0.96	10.30a 1.70	9.56b 1.43	9.93 1.61	9.77a 1.14	10.29b 1.59	10.02 1.39	9.56 1.50	9.39 1.82	9.47 1.67	9.61 1.79	9.51 1.79	9.56 1.79	8.96A 1.51	9.62B 1.68	9.29 1.63
Standardized height of loin eye in P4 point Standaryzowana wysokość oka poślednicy w punkcie P4	$\bar{x}$ 53.80 s 1.78	53.45 3.06	53.64 2.42	53.45A 2.47	54.97B 2.24	54.21 2.47	54.09a 3.27	55.53b 3.70	54.79 3.54	53.22a 3.79	54.21b 4.45	53.71 4.16	53.50 3.81	54.29 3.17	54.29 3.17	53.78 3.85	53.96 3.66	53.87 3.75
Standardized body meat content Standaryzowana zawartość mięsa w ciele	$\bar{x}$ 59.77A s 0.83	57.98B 1.51	58.95 1.48	59.48 2.31	59.56 1.49	59.52 1.93	59.76A 1.83	58.24B 1.37	59.03 1.79	58.92a 2.13	58.44b 2.53	58.68 2.35	60.08A 1.91	58.82B 1.83	58.82 1.83	59.69A 1.96	58.15B 2.09	58.91 2.16
Performance test selection index Indeks selekcyjny oceny przyżyciowej	$\bar{x}$ 92.20 s 3.97	90.88 6.48	91.59 5.24	93.41A 11.62	105.03B 9.37	99.22 12.01	94.45A 8.25	99.63B 8.50	96.96 8.73	87.32A 11.75	102.36B 13.47	94.88 14.71	89.13A 8.90	98.44B 8.83	98.44 8.83	91.01A 9.21	100.44B 11.24	95.76 11.30

Averages in rows within particular breed marked by different letters significantly differ each other; capital letters -  $P \leq 0.01$ ; small letters -  $P \leq 0.05$ Średnie w rzędach w obrębie danej rasy oznaczone różnymi literami istotnie różnią się od siebie: wielkie liter -  $P \leq 0.01$ ; małe litery -  $P \leq 0.05$

Table 4. The results of growth and slaughter traits of tested young crossbred boars performance tested in year 2006

Tabela 4. Wyniki cech tucznych i rzeźnych badanych knurków mieszańców poddanych ocenie przyżyciowej w 2006 roku

Traits Cechy	The daily gain of body weight of young boars standardized on 180th day of life (g) Przyrost dobowy masy ciała knurków standaryzowany na 180. dzień życia (g)											
	H x D h x d			H x P h x p			D x P d x p			990 x P 990 x p		
	low niski	high wysoki	total łącznie	low niski	high wysoki	total łącznie	low niski	high wysoki	total łącznie	low niski	high wysoki	total łącznie
Number, n Liczebność, szt.	37	39	76	36	32	68	241	246	487	13	11	24
Age on test day Wiek w dniu oceny	$\bar{x}$ 189.95A s 6.48	183.18B 6.22	186.47 7.17	188.81a 10.41	182.25b 10.14	185.72 10.76	186.05A 13.14	174.79B 12.32	180.36 13.92	197.62A 7.04	174.64B 7.09	187.08 13.58
Body weight on test day Masa ciała w dniu oceny	$\bar{x}$ 119.95A s 5.86	126.03B 6.62	123.07 6.93	118.92A 11.61	129.91B 12.58	124.09 13.20	111.95A 11.84	123.61B 13.26	117.84 13.86	117.69 6.40	114.36 4.48	116.17 5.74
Daily gain of body weight standardized on 180th day of life Przyrost dobowy masy ciała standaryzowany na 180. dzień życia	$\bar{x}$ 616.03A s 13.76	682.97B 32.35	650.38 41.90	616.64A 39.16	708.72B 32.95	659.97 58.72	594.63A 45.27	720.07B 51.00	658.00 79.15	572.08A 27.77	667.18B 40.91	615.67 58.93
Standardized backfat thickness in P2 point Standaryzowana grubość słoniny w punkcie P2	$\bar{x}$ 8.11A s 0.82	7.55B 0.87	7.82 0.89	8.02 1.02	7.84 0.85	7.93 0.94	9.41A 1.61	8.56B 1.77	8.98 1.75	8.15a 1.26	9.07b 0.75	8.57 1.14
Standardized backfat thickness in P4 point Standaryzowana grubość słoniny w punkcie P4	$\bar{x}$ 9.70A s 0.90	8.38B 1.31	9.02 1.30	8.89 1.59	8.78 1.35	8.84 1.47	9.51A 1.29	9.09B 1.50	9.30 1.41	10.05 1.61	9.99 1.45	10.02 1.50
Standardized height of loin eye in P4 point Standaryzowana wysokość oka połędwicy w punkcie P4	$\bar{x}$ 54.79 s 2.65	55.54 3.03	55.18 2.86	56.23 5.42	56.17 4.24	56.20 4.87	54.77A 3.79	56.13B 3.99	55.46 3.94	53.75a 4.04	57.95b 5.44	55.67 5.09
Standardized body meat content Standaryzowana zawartość mięsa w ciele	$\bar{x}$ 60.74 s 1.13	61.22 1.42	60.98 1.30	61.60 1.44	61.06 1.33	61.35 1.40	59.89 2.35	59.91 2.36	59.90 2.35	61.02a 1.49	59.80b 1.29	60.46 1.51
Performance test selection index Indeks selekcyjny oceny przyżyciowej	$\bar{x}$ 98.81A s 6.16	110.26B 8.90	104.68 9.57	103.11A 8.60	113.09B 7.14	107.81 9.35	91.90A 12.42	109.13B 12.79	100.60 15.26	94.31a 8.79	101.27b 6.40	97.50 8.41

Averages in rows within particular breed marked by different letters significantly differ each other; capital letters -  $P \leq 0.01$ ; small letters -  $P \leq 0.05$

Średnie w rzędach w obrębie danej rasy oznaczone różnymi literami istotnie różnią się od siebie; wielkie liter -  $P \leq 0,01$ ; małe litery -  $P \leq 0,05$

Table 5. The results of growth and slaughter traits of tested young crossbred boars performance tested in year 2007

Tabela 5. Wyniki cech tucznych i rzeźnych badanych knurków mieszańców poddanych ocenie przyżyciowej w 2007 roku

Traits Cechy	The daily gain of body weight of young boars standardized on 180th day of life (g) Przyrost dobowy masy ciała knurków standaryzowany na 180. dzień życia (g)																	
	H x D h x d			H x P h x p			D x H d x h			D x P d x p			P x H p x h			P x D p x d		
	low niski	high wysoki	total łącznie	low niski	high wysoki	total łącznie	low niski	high wysoki	total łącznie	low niski	high wysoki	total łącznie	low niski	high wysoki	total łącznie	low niski	high wysoki	total łącznie
Number, n Liczebność, szt.	13	13	26	29	25	54	8	9	17	268	247	515	48	49	97	93	92	185
Age on test day Wiek w dniu oceny	$\bar{x}$ 189.00A s 7.27	169.69B 6.58	179.35 11.96	187.03A 5.68	177.00B 11.80	182.39 10.28	181.00 3.51	178.56 3.09	179.71 3.42	185.57A 11.86	176.17B 10.20	181.06 12.04	192.60A 9.18	177.86B 11.50	185.15 12.74	191.65A 14.10	181.79B 13.62	186.75 14.68
Body weight on test day Masa ciała w dniu oceny	$\bar{x}$ 138.69A s 11.18	135.62B 10.47	137.15 10.72	125.52 13.73	138.56 11.60	131.56 14.27	138.88A 3.14	149.89B 10.23	144.71 9.42	113.85A 12.10	126.66B 11.53	119.99 13.44	109.15A 6.62	125.86B 15.68	117.59 14.66	108.80A 16.01	132.65B 15.98	120.66 19.94
Daily gain of body weight standardized on 180th day of life Przyrost dobowy masy ciała standaryzowany na 180. dzień życia	$\bar{x}$ 717.69A s 45.68	824.46B 34.70	771.08 67.41	658.21A 56.89	792.16B 40.02	720.22 83.55	765.88A 27.18	842.56B 45.41	806.47 53.95	606.12A 44.68	728.70B 49.03	664.91 77.10	550.58A 27.61	712.39B 61.24	632.32 94.13	551.84A 51.62	728.55B 66.94	639.72 106.76
Standardized backfat thickness in P2 point Standaryzowana grubość słoniny w punkcie P2	$\bar{x}$ 7.02 s 1.25	6.95 1.09	6.98 1.15	7.26 1.05	6.79 0.92	7.04 1.01	7.00 0.95	6.62 1.03	6.80 0.98	9.02A 1.52	8.14B 1.70	8.60 1.66	9.60A 1.41	7.60B 1.29	8.59 1.68	9.27A 1.66	7.68B 1.47	8.48 1.76
Standardized backfat thickness in P4 point Standaryzowana grubość słoniny w punkcie P4	$\bar{x}$ 7.98 s 1.55	7.02 1.36	7.50 1.51	8.16 1.25	8.02 1.64	8.09 1.43	8.34a 0.48	7.41b 0.99	7.85 0.91	9.08A 1.36	8.71B 1.55	8.90 1.46	9.49A 1.45	8.44B 1.45	8.96 1.54	8.83A 1.49	8.07B 1.42	8.45 1.50
Standardized height of loin eye in P4 point Standaryzowana wysokość oka połędwicy w punkcie P4	$\bar{x}$ 57.31 s 4.08	57.26 2.60	57.28 3.35	57.58 4.75	57.91 3.88	57.73 4.33	58.55 2.32	56.64 2.84	57.54 2.71	55.45A 4.04	56.79B 4.15	56.09 4.14	54.83A 2.75	56.76B 2.89	55.81 2.97	54.93 3.49	56.00 3.98	55.46 3.77
Standardized body meat content Standaryzowana zawartość mięsa w ciele	$\bar{x}$ 62.89 s 1.84	61.50 1.13	62.20 1.66	62.55a 1.79	62.04b 1.51	62.31 1.67	62.34 0.95	62.04 0.76	62.18 0.84	60.46 2.22	60.61 2.12	60.53 2.18	60.45a 1.59	61.15b 1.86	60.80 1.76	60.92 1.90	61.41 2.05	61.16 1.99
Performance test selection index Indeks selekcyjny oceny przyżyciowej	$\bar{x}$ 122.85A s 13.03	131.08B 7.65	126.96 11.28	113.38 11.35	129.20 8.30	120.70 12.75	127.00a 5.18	135.89b 7.46	131.71 7.78	96.17A 12.81	113.62B 12.00	104.54 15.18	88.54A 7.11	114.02B 12.95	101.41 16.51	91.01A 12.70	117.46B 15.06	104.16 19.20

Averages in rows within particular breed marked by different letters significantly differ each other; capital letters -  $P \leq 0.01$ ; small letters -  $P \leq 0.05$

Średnie w rzędach w obrębie danej rasy oznaczone różnymi literami istotnie różnią się od siebie; wielkie liter -  $P \leq 0,01$ ; małe litery -  $P \leq 0,05$

Table 6. The results of growth and slaughter traits of tested young crossbred boars performance tested in year 2008

Tabela 6. Wyniki cech tucznych i rzeźnych badanych knurków mieszańców poddanych ocenie przyżyciowej w 2008 roku

Traits Cechy	The daily gain of body weight of young boars standardized on 180th day of life (g) Przyrost dobowy masy ciała knurków standaryzowany na 180. dzień życia (g)											
	H x P h x p			D x P d x p			P x H p x h			P x D p x d		
	low niski	high wysoki	total łącznie	low niski	high wysoki	total łącznie	low niski	high wysoki	total łącznie	low niski	high wysoki	total łącznie
Number, n Liczebność, szt.	36	35	71	201	203	404	63	63	126	115	115	230
Age on test day Wiek w dniu oceny	$\bar{x}$ 178.22A s 8.80	171.06B 9.62	174.69 9.83	185.23A 12.32	166.00B 10.24	175.57 14.85	177.70A 14.62	168.43B 11.32	173.06 13.83	187.71A 15.72	181.50B 14.66	184.61 15.49
Body weight on test day Masa ciała w dniu oceny	$\bar{x}$ 115.94A s 10.22	135.14B 7.95	125.41 13.28	113.78A 12.19	127.44B 11.78	120.64 13.79	102.44a 11.88	107.11b 13.25	104.78 12.75	106.11A 14.72	124.59B 14.86	115.35 17.42
Daily gain of body weight standardized on 180th day of life Przyrost dobowy masy ciała standaryzowany na 180. dzień życia	$\bar{x}$ 654.56A s 41.14	814.97B 54.55	733.63 93.89	607.81A 51.45	806.54B 83.17	707.67 121.16	581.73A 19.90	658.52B 34.32	620.13 47.61	554.74A 31.02	688.18B 76.59	621.72 88.72
Standardized backfat thickness in P2 point Standaryzowana grubość słoniny w punkcie P2	$\bar{x}$ 9.05A s 1.74	6.88B 1.15	7.98 1.83	9.13A 1.68	7.74B 1.75	8.43 1.85	10.19A 1.26	9.58B 1.37	9.88 1.35	9.59A 1.77	8.13B 1.69	8.86 1.88
Standardized backfat thickness in P4 point Standaryzowana grubość słoniny w punkcie P4	$\bar{x}$ 9.68A s 1.57	7.51B 1.65	8.61 1.94	9.17A 1.49	8.18B 1.52	8.67 1.58	9.63 1.29	9.32 1.23	9.47 1.27	9.03A 1.51	8.01B 1.63	8.52 1.65
Standardized height of loin eye in P4 point Standaryzowana wysokość oka połędwicy w punkcie P4	$\bar{x}$ 58.58 s 4.01	58.72 3.47	58.65 3.73	55.15A 3.79	58.16B 3.52	56.66 3.95	57.17 2.19	57.57 2.85	57.37 2.54	55.34 2.80	55.36 3.92	55.35 3.40
Standardized body meat content Standaryzowana zawartość mięsa w ciele	$\bar{x}$ 60.50A s 1.53	61.96B 1.24	61.22 1.56	60.23a 2.29	60.65b 1.90	60.44 2.11	59.53 1.50	59.29 1.22	59.41 1.37	60.44a 2.17	60.99b 2.05	60.72 2.12
Performance test selection index Indeks selekcyjny oceny przyżyciowej	$\bar{x}$ 103.03A s 10.12	131.89B 7.90	117.25 17.11	95.34A 12.88	124.41B 14.98	109.95 20.17	88.48A 6.93	97.73B 8.35	93.10 8.94	89.13A 12.04	109.93B 15.05	99.53 17.13

Averages in rows within particular breed marked by different letters significantly differ each other; capital letters -  $P \leq 0.01$ ; small letters -  $P \leq 0.05$

Średnie w rzędach w obrębie danej rasy oznaczone różnymi literami istotnie różnią się od siebie; wielkie liter -  $P \leq 0,01$ ; małe litery -  $P \leq 0,05$